BREEDING AND DEVELOPMENT OF *RANA CYANOPHLYCTIS* SCHNEIDER

P. Mohanty-Hejmadi and Sushil K. Dutta[2]

(*With five text-figures*)

The breeding habits and development of the Skipper frog *Rana cyanophlyctis* Schneider were observed in the populations under natural conditions as well as laboratory maintained ones. Data collected on the development under natural conditions and the development of artificially inseminated laboratory raised tadpoles, showed that in both cases maximum growth in terms of weight and length, occurred during premetamorphic stage. A dramatic decrease, approximately 32% loss in weight and 67% loss in length, occured during the "metamorphic climax" when the tadpole changed into a froglet.

Introduction

The commonest of Indian Ranidae, the Skipper frog *Rana cyanophlyctis* Schneider is widely distributed over India. They are found in ponds, water reservoirs, ditches and rain water puddles. An excellent description of their habits has been given by Daniel (1975). This study was undertaken to record the breeding habits and development of the Skipper frog found in plenty in Bhubaneswar, Orissa, (Mohanty-Hejmadi 1977 a).

Materials and methods

Observations on breeding behaviour was done in the Vani Vihar, Utkal University Campus area from January till December, 1976. Tadpoles at various stages were collected from a permanent water reservoir of a depth of approximately 46 cm ($1\frac{1}{2}$ feet), as early as 26th April, 1976 before the monsoons arrived. Egg masses, tadpoles and juveniles were collected from temporary and permanent pools of water during the monsoon season from June to August. Tadpoles were also collected in early September. Observations were made at periodic intervals. The larvae were raised in stock tanks (Group-A). Individual variation was seen in length and weight of full siblings at same stage of development. Randomly selected pre-metamorphic tadpoles at same stage of development were separated (Group-B) from stock tanks for study of metamorphosis. These tadpoles were raised in groups of eight in identical finger bowls under conditions standardized in Laboratory (Mohanty-Hejmadi 1977 b). They were fed daily with fish food and vegetable greens. The range of temperature in the laboratory during this period was from 32°C to 41°C. Tadpoles at pre-limb stage were designated as Stage I, with well developed hind limbs as stage-II, upon reaching four-limbed stage as stage-III and after completion of metamorphosis as Stage-IV juveniles. Stage-I, II and III are comparable to the pre-metamorphic, pro-metamorphic and metamorphic climax stages respectively, described by Witschi (1956) for *Rana pipiens*. At stage-III, the tadpoles were transferred into amphibious environment set up as described earlier (Mohanty-Hejmadi 1977 c). The length

[1] Accepted March 1978.

[2] Department of Zoology, Utkal University, Vani Vihar, Bhubaneswar-751 004 (Orissa).

and weight of the tadpoles were taken at periodic intervals. For comparative purpose, tadpoles at Stage-I, II, III and Stage-IV juveniles were also collected from nature. Eggs either from natural spawning in the laboratory or from artificial insemination, were raised through metamorphosis.

Observations

Skipper frogs were seen in both temporary and permanent water pools around Vani Vihar campus throughout the study period. During the winter from November through January, frogs were seen basking in the sun either by sitting on the edges of the pool or by perching on the walls of cemented water tanks. Towards the end of March and in April, a mass migration of frogs occurred during the night from the drying pools to more permanent bodies of water. In a few cases pairs in amplexus were seen.

Since the monsoon did not start until May, tadpoles collected during April, 1976 represented the progeny of frogs who were early breeders taking advantage of the sporadic rains in March, and April. Pre-metamorphic tadpoles were collected even in September indicating that the breeding period lasts from April to September. Since egg masses or embryos were not found in temporary puddles which resulted from sporadic rainfalls during pre-monsoon period, it was concluded that early breeders use permanent water tanks to breed. When the rainfall became more frequent towards the end of May, mature males and females gathered in the evening in rain water puddles, ditches and ponds. They were the leaders of the "amphibian chorus" which was heard both during the day and night. The males and females went into amplexus mostly at night, the amplexus continued throughout the day. Frogs maintained in the laboratory also called, went into amplexus when it rained outside, and even laid eggs spontaneously. Most of the egg masses laid in the laboratory did not grow probably because of the fouling of water resulting from the high concentration of animals in the tanks. However, it was possible to raise tadpoles from one such egg mass.

It is interesting to note that, although pairs in amplexus were seen both during the day and night, in nature as well as laboratory, the ovulation took place only at night. The breeding period lasted from April to September, most of them spawning during the heavy monsoons from middle of June to end of July. The egg masses with 300 to 500 per clutch, were laid in shallow water. The eggs had grayish brown animal pole and pale yellow or white vegetal pole. The diameter of the eggs was approximately 1.0 mm. A week after fertilization, the tadpoles reached a length of 9.25 mm. The characteristic black blotches of the tail (Annandale & Rao 1918; Daniel 1975) appeared when the tadpoles reached a length of about 13.00 mm. Pre-metamorphic tadpoles were occasionally seen eating away dead tadpoles. The Stage-II tadpoles had a mouth disc with one complete row of teeth in the upper lip, and two rows of teeth on the lower lip, and a heavy black serrated beak (Fig. 1).

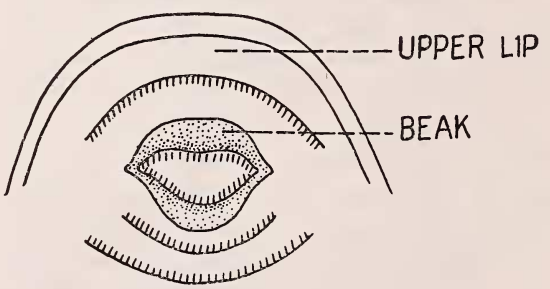

Fig. 1. Teeth structure

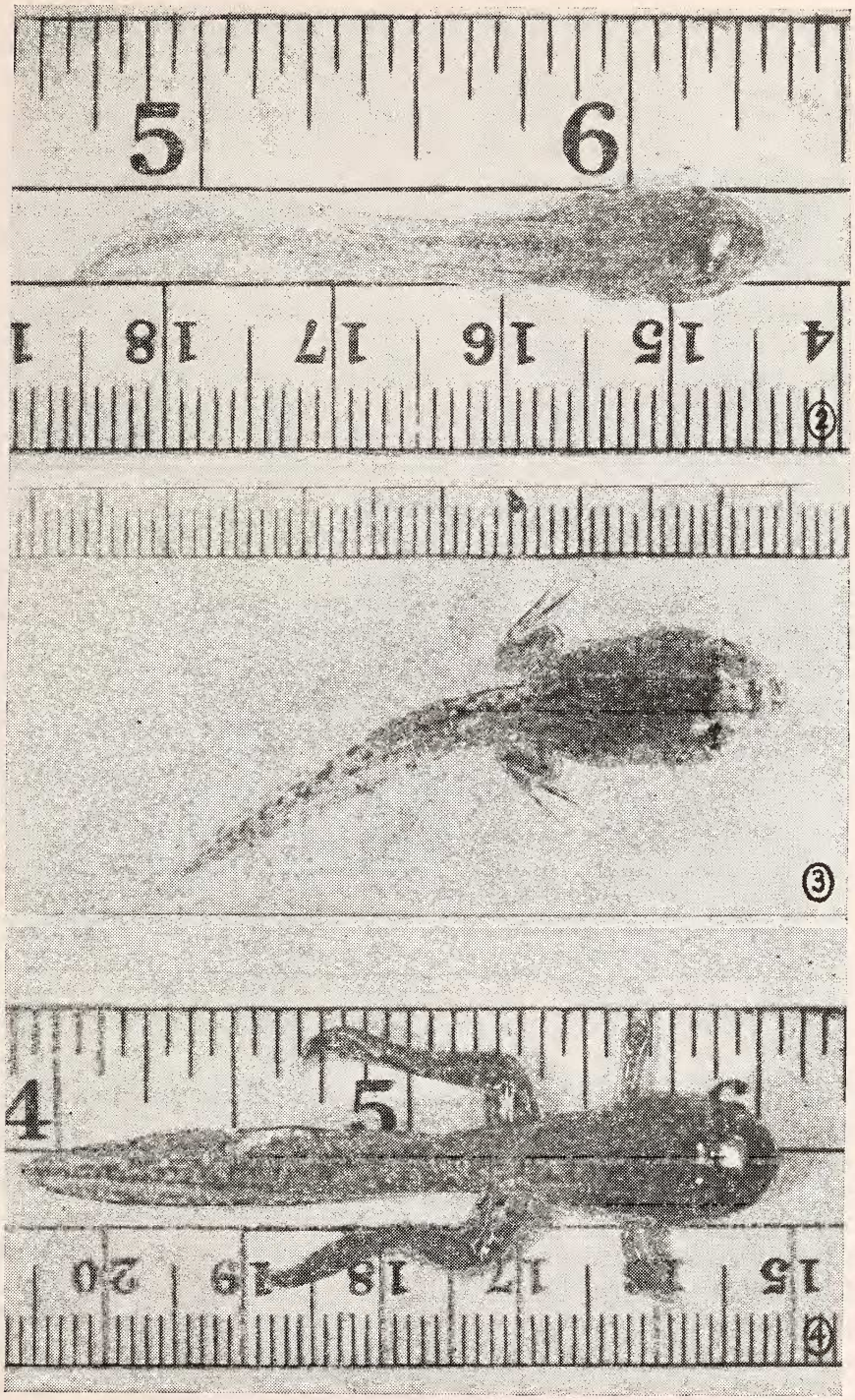

Fig. 2. Pre-metamorphic tadpole. Fig. 3. Pro-metamorphic tadpole.
Fig. 4. Four limbed tadpole at metmorphic climax.

Same teeth structure has been reported by Daniel (1975), which differs from McCann's (1932) observations. According to the diagram given by McCann, there are three rows of teeth in the upper lip and four rows of teeth in the lower lip. The time period for completion of life cycle depended on the conditions under which they were raised. The Group-A tadpoles raised in "Stock tanks" under crowded conditions metamorphosed 15 to 60 days post fertilization. It is interesting to note that four of the stock remained at Stage-II for a considerable period of time. Only one of these four reached stage III in 90 days and completed metamorphosis in 94 days after fertilization. The other three died without reaching Stage-III. In group B tadpoles, the life cycle was much shorter, and there was 100% metamorphosis.

Observations on Group-B Tadpoles:

Towards the end of third week post-fertilization, pre-metamorphic tadpoles (Fig. 2) reached pro-metamorphic (Fig. 3) stage and developed hind limbs. It took fourteen days to complete development of hind limbs. Towards the end of this period the tadpoles reached stage-III (Fig. 4) with the emergence of fore limbs, the right fore limb emerging first in more than 50% of the tadpole observed. The other forelimb emerged within three hours of the emergence of the first. This stage marks the beginning of "metamorphic climax" when several drastic changes occur within a very short period. Stage-III tadpoles took approximately six days to metamorphose completely. Thus the average period of development from egg through metamorphosis was approximately 46 days or six and half weeks in the laboratory.

Between stage-I and stage-II, the larvae developed more pigmented blotches. During the stage-III, the head region became demarcated from the rest of the body. Most of the adult features such as characteristic pigmented spots on the dorsal surface and the webbing of feet developed between stage-III and stage-IV. The mouth shifted from ventral side to the snout and extended upto the sides of the eye. The tadpoles as expected, stopped eating during metamorphosis.

Growth of Gfoup-B Tadpoles during metamorphosis:

Larvae randomly selected at pre-metamorphic stage (Stage-I) ranged from 26 mm to 45 mm with an average of 35 mm in length, and 330 mg to 550 mg with an average of 500 mg in weight (Table-1, Fig. 5). Pro-metamorphic or stage-II larvae ranged from 43 mm to 62 mm with an average of 53 mm in length

TABLE 1 (Fig. 5)

CHANGE IN LENGTH AND WEIGHT DURING METAMORPHOSIS

Stage	Average length in mm	%Change in length from previous stg.	Average weight in mg	%Change in weight from prev. stg
I	35 ± 0.42*		500	
II	53 ± 0.46*	51	1,300	+ 160
III	52 ± 0.25	– 2	1,100	– 15
IV	17 ± 0.18	– 67	750	– 32

(*) Standard error.

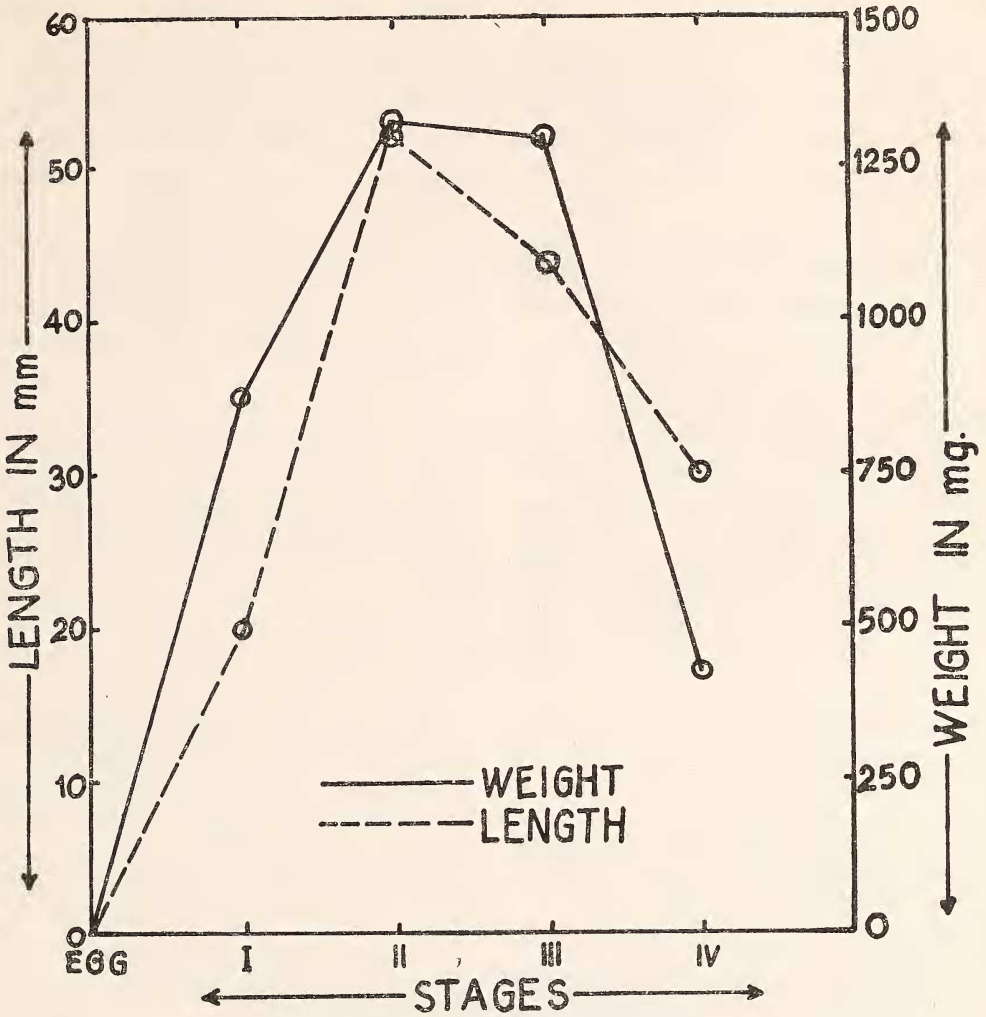

Fig. 5. Growth during metamorphosis.

and from 1333 mg to 1541 mg with an average of 1300 mg in weight. At the beginning of metamorphic climax, stage-III, the larvae ranged from 49 mm to 57 mm with an average of 52 mm in length, and from 1125 mg to 1237 mg with an average of 1100 mg in weight. Newly metamorphosed juveniles ranged from 16 mm to 21 mm with an average of 17 mm in length and from 675 mg to 850 mg with an average of 750 mg in weight. Maximum growth (160%) occurred between stage I and Stage II. Maximum loss in length and weight occurred between stage-III and stage-IV (Table 1). This loss was mainly due to the loss of tail during metamorphosis.

Discussion

The breeding behaviour and development was typically Anuran. Breeding took place mainly during monsoons as reported by other workers (Ferguson 1904: McCann 1932). McCann has indicated about the possibility of *R. cyanophlyctis* breeding at other times under suitable circumstances. Presence of small tadpoles before monsoons would support this view.

There was rapid growth during pre and early pro-metamorphic stage which levelled off at the end of the pro-metamorphic stage. The slight loss during late pro-metamorphosis (Fig. 5) was similar to that reported for other species of Amphibians (Weber 1967). The shorter life cycle in group B in comparison to that of group A was probably due to the lower concentrations of tadpoles in the former. The short time of development, i.e. six half weeks in comparison to other species like 3 months for *Rana pipiens*, or 4 months for *Rana catesbaeana* is probably due to the tropical climate. Stage-I, II and IV larvae collected from nature were consistantly heavier and longer than laboratory raised tadpoles at comparable stages. The difference was probably due to the difference in density, nutrients and temperature as all these parameters affect growth (Richards 1958, Rugh 1962).

The eating of dead tadpoles by pre-metamorphic tadpoles confirms that they are larvivorous (McCann 1932) and probably eat flesh of any dead animal where available. However, true cannibalism was not observed in these tadpoles.

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